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ABSTRACT

This document, which reflects Mississippi's statutory requirement that instructional programs be based on core curricula and performance-based assessment, contains outlines of the instructional units required in local instructional management plans and daily lesson plans for vehicle and mobile equipment mechanics I and II. Presented first are a program description and course outlines. Section I contains curriculum frameworks for both courses, and section II contains outlines of the instructional units required in each course. Vehicle and Mobile Equipment I contains the following five units: (1) orientation and safety; (2) tools, technical references, measurement, and fasteners; (3) basic vehicle service; (4) brakes; and (5) basic electrical service. The second-level course contains these five units: (1) engine performance--gasoline and diesel; (2) drive trains; (3) steering and suspension systems; (4) air conditioning and heating service; and (5) hydraulics. Each unit includes suggested time on tasks, competencies and objectives, teaching strategies, assessment strategies, and resources. Recommended tools and equipment are listed in section III. Appended are lists of related academic topics and workplace skills for the 21st century and student competency profiles for both courses. (KC)

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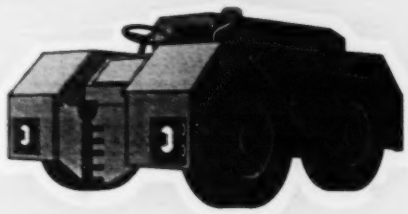
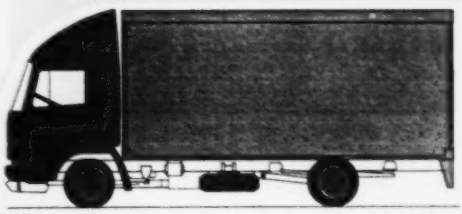
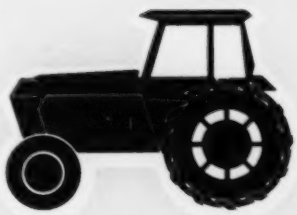
ED 397 321

Mississippi Curriculum Framework for

Vehicle and Mobile Equipment Mechanics







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Secondary Vocational and Technical Education 1995

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August 1, 1995

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CURRICULUM FRAMEWORK

FOR

VEHICLE AND MOBILE EQUIPMENT MECHANICS

(PROGRAM CIP: 47.0699 - VEHICLE AND MOBILE EQUIPMENT MECH.)

SECONDARY PROGRAMS 1995

August 1, 1995

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FOREWORD

The courses in this document reflect the following statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended:

> The State Department of Education shall provide an instructional program and establish guidelines and procedures for managing such programs in the public schools as part of the State Program of Educational Accountability and Assessment of Performance. . .
>
> The department shall provide that such program or guidelines . . . are enforced through the performance-based accreditation system.
>
> The local school board must adopt the objectives that will form the core curriculum that will be systematically delivered throughout the district.
>
> Standards for student performance must be established for each core objective in the local program and those standards establish the district's definition of mastery for each objective.
>
> There shall be an annual review of student performance in the instructional program against locally established standards.

Each secondary vocational-technical course consists of a series of instructional units which focus on a common theme. All units have been written using a common format which includes the following components:

- Unit Number and Title
- Suggested Time on Task - The number of days of instruction that should be required to teach the competencies and objectives of the unit. For secondary occupational programs, a "day" represents a two-period block of instruction.
- Competencies and Suggested Objectives
  - A **Competency** represents a general concept of performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies in the curriculum framework.
  - The **Suggested Objectives** represent the enabling and supporting knowledge and performances that will indicate mastery of the competency.
- Suggested Teaching Strategies - This section of each unit indicates strategies that can be used to enable students to master each suggested objective. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.

- Suggested Assessment Strategies - This section indicates strategies that can be used to measure student mastery. Examples of suggested strategies could include classroom discussions, laboratory exercises, and student assignments. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources.
- Suggested Resources - This section indicates some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested and the list may be modified or enhanced based on needs and abilities of students and on available resources.

The following guidelines were used in developing the curriculum framework in this document and should be considered in developing local instructional management plans and daily lesson plans:

- The content of the courses in this document reflects approximately 75 percent of the time allocated to each course. For a one-year course, this means that the content of the existing units of instruction should represent approximately 135 days of instruction. The remaining 25 percent of each course should be developed at the local district level and may reflect:
  - Additional units of instruction within the course related to topics not found in the state framework.
  - Activities which develop a higher level of mastery on the existing competencies and suggested objectives.
  - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed/revised.
  - Activities which implement components of the Mississippi Tech Prep Initiative, including integration of academic and vocational-technical skills and coursework, school-to-work transition activities, and articulation of secondary and postsecondary vocational-technical programs.
  - Individualized learning activities, including work site learning activities, to better prepare individuals in the courses for their chosen occupational area.

- Sequencing of the units of instruction within a course is left to the discretion of the local district. Naturally, foundation units related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other units related to specific skill areas in the course, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors.

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PROGRAM DESCRIPTION

Vehicle and Mobile Equipment Mechanics

(Program CIP: 47.0699 - Vehicle & Mobile Equipment Mech.)

Vehicle and Mobile Equipment Mechanics is a two-year instructional program that provides students with a foundation of skills and knowledge related to the service and repair of vehicles and power equipment. Students who complete the program may enter employment in an entry level position or continue their education in a postsecondary technical program such as automotive technology, diesel equipment technology, and other related areas. Students receive instruction in the maintenance and service of a variety of vehicles including small equipment, automobiles, trucks, and tractors/construction equipment. The program consists of two courses, each nine months in length. Each course must be taught in a minimum two-class period block. The first course in the program includes instruction in the foundation skills related to safety, tool and equipment usage, measurement, basic vehicle service, and brake and electrical system service. The second course in the program provides students with foundation skills related to gasoline and diesel engine performance, drive trains, steering and suspension systems, air conditioning/heating, and hydraulic service.

COURSE OUTLINE

VEHICLE AND MOBILE EQUIPMENT MECHANICS I

Unit No.	Title	No. of Days
1	Orientation and Safety	15
2	Tools, Technical References, Meausrement, and Fasteners	20
3	Basic Vehicle Service	35
4	Brakes	30
5	Basic Electrical Service	35

VEHICLE AND MOBILE EQUIPMENT MECHANICS II

Unit No.	Title	No. of Days
1	Engine Performance - Gasoline and Diesel	65
2	Drive Trains	30
3	Steering and Suspension Systems	20
4	Air Conditioning and Heating Service	10
5	Hydraulics	10

August 1, 1995

SECTION I:

CURRICULUM FRAMEWORK

FOR

VEHICLE & MOBILE EQUIPMENT MECHANICS

CURRICULUM FRAMEWORK

Course Name: Vehicle and Mobile Equipment Mechanics I

Course CIP Code: 47.0601

Course Description: Vehicle and Mobile Equipment Mechanics I is the entry level course of the secondary Vehicle and Mobile Equipment Mechanics program. Students in the course will gain foundation competencies related to a variety of vehicles in the following areas: safety, tool and equipment usage, measurement, basic vehicle service, brakes, and basic electrical service. (2-2½ Carnegie units, depending upon time spent in the course)

Competencies and Suggested Objectives:

1. Review occupational and leadership opportunities in vehicle and mobile equipment mechanics.
   a. Investigate occupational opportunities in the local area.
   b. Update the student's Career/Educational Plan.
   c. Describe leadership opportunities available from student youth organizations in the school and community, including VICA.

   Related Academic Topics (See Appendix A):
   C1, C4, C6

   Workplace Skills (See Appendix B):
   WP2, WP3, WP6
2. Demonstrate safety procedures used in vehicle service.
   a. Apply safety rules for personal and general shop safety including eye (State Eye Safety Law provisions), ear, and body protection; general rules of shop conduct; and the use of safety color coding in automotive shops.
   b. Apply general safety rules for tool and shop equipment use including use of hand tools, air and electric power tools, and other shop equipment.
   c. Apply general safety rules associated with working on various vehicle systems.
   d. Apply rules and procedures associated with fire safety including procedures for handling and storing flammable liquids and proper use of fire fighting devices.

   Related Academic Topics (See Appendix A):
   C2, C4
   S5, S6, S8

   Workplace Skills (See Appendix B):
   WP5
3. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.
   a. Recognize signal words and symbols that indicate severity of a hazard.

b. Describe methods for reducing hazardous waste.
c. Describe procedures for storing hazardous waste.
d. Interpret data found on a hazardous material safety data sheet.
e. Describe general safety procedures for first aid and cleanup to follow in case of an accident involving hazardous materials.
f. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.

Related Academic Topics (See Appendix A):

C1, C2, C4
S5, S8

Workplace Skills (See Appendix B):

WP2, WP3, WP4, WP5, WP6

4. Demonstrate safe and proper use and storage of tools and equipment in a vehicle shop.
   a. Identify and demonstrate the safe and proper use of common hand tools including wrenches, sockets, pliers, screwdrivers, striking tools, etc.
   b. Identify and demonstrate the safe and proper use of lifting and hoisting equipment.
   c. Identify and demonstrate the safe and proper use of cleaning equipment.
   d. Identify and demonstrate the safe and proper use of power equipment including impact wrenches, drills, grinders, and presses.
   e. Organize and maintain a systematic storage system for hand and power tools.

   Related Academic Topics (See Appendix A):

   C2, C4
   S8

   Workplace Skills (See Appendix B):

   WP1, WP5, WP6

5. Locate and apply service specifications and information.
   a. Locate service specifications and information, using both print and computerized service information references.
   b. Interpret and apply information to a specific job on a specific vehicle.
   c. Locate and interpret vehicle and major component identification numbers (VIN, certification, and calibration labels).

   Related Academic Topics (See Appendix A):

   C1, C4
   M1, M4
   S8

   Workplace Skills (See Appendix B):

   WP2, WP5, WP6

6. Demonstrate measurement practices used in vehicle service.
   a. Measure the length of an object using a rule to the nearest 1/16th of an inch and 1 millimeter.

b. Measure the inside diameter, outside diameter, and/or depth to the nearest .001 of an inch and nearest .1 millimeter, using precision measuring instruments (micrometers, calipers, and dial indicators).

Related Academic Topics (See Appendix A):

M4
S8

Workplace Skills (See Appendix B):

WP2, WP5

7. Identify common fasteners and describe their use.
   a. Identify the different types of bolts, nuts, and washers and describe their appropriate uses.
   b. Identify bolts by grade, diameter, length, and thread pitch.
   c. Identify different glues and sealants used in automotive service and describe their appropriate use.
   d. Restore internal and external threads.

   Related Academic Topics (See Appendix A):

   C2
   M1, M5
   S6

   Workplace Skills (See Appendix B):

   WP2, WP5, WP6
8. Identify and describe the major systems and components of a vehicle.
   a. Identify the major components and describe their purpose/function of following major systems:
      i. power train
      ii. chassis, steering, and suspension
      iii. fuel
      iv. electrical
      v. cooling
      vi. exhaust
   b. Describe the operation of a four-stroke cycle engine.
   c. Describe the use of electornics and computer control in modern vehicles.

   Related Academic Topics (See Appendix A):

   C1, C2, C4
   S4

   Workplace Skills (See Appendix B):

   WP2, WP4, WP5
9. Perform lubrication maintenance and general inspection service.
   a. Discuss the importance of regularly scheduled maintenance procedures as outlined in the owners manual and related to vehicle performance and longevity.
   b. Complete a work order and maintenance record for a given vehicle.
   c. Visually inspect the engine lubrication system for leaks and determine needed repairs.

d. Select proper lubricants and filters for lubrication service.
e. Change engine oil and filter according to manufacturer's specifications and in accordance with disposal procedures.
f. Perform a chassis and body lubrication.
g. Inspect and service as needed other filters on the engine including air, fuel, pcv valve, crankcase vent filters, etc.
h. Conduct a general preventive maintenance inspection of hoses and belts, fluid levels, wiper blades, headlights and accessory lights, tires, exhaust, shocks, etc; repair/replace/adjust as needed.
i. Clean and service a battery including case, cables and connections, and checking electrolyte level (If applicable). (Maintain electronic memory functions while cleaning.)
j. Discuss differences in servicing a diesel engine as compared to a gasoline engine, including replacing fuel filters and bleeding the diesel fuel system.

Related Academic Topics (See Appendix A):

C6
M4
S5, S6, S8

Workplace Skills (See Appendix B):

WP1, WP2, WP4, WP5

10. Perform cooling system maintenance.
    a. Drain and refill a cooling system.
    b. Inspect and pressure test a cooling system for proper operation, repair/replace thermostats, hoses, radiator caps, etc., as needed.
    c. Test condition and strength of antifreeze/coolant.

Related Academic Topics (See Appendix A):

C4
M1
S5, S6

Workplace Skills (See Appendix B):

WP2, WP3, WP5, WP6

11. Perform wheel and tire service.
    a. Identify types and classifications for tires.
    b. Remove and install a wheel assembly to manufacturer's torque specifications.
    c. Inspect tires for proper inflation and abnormal wear.
    d. Dismount, repair, and remount a tire on a wheel.
    e. Balance a tire to industry standards.
    f. Rotate tires following vehicle manufacturer's recommendations.
    g. Diagnose and determine needed repair for abnormal tire wear, to include recognizing symptoms of incorrect camber, caster, and toe alignment.

Related Academic Topics (See Appendix A):

C1, C4
M4
S5, S6

Workplace Skills (See Appendix B):

WP2, WP3, WP5, WP6

12. Perform a basic overhaul of the brake system.
    a. Describe basic hydraulic principles and brake operations, including selection and handling/storage of brake fluid.
    b. Compare the operation of a standard brake system to an anti-lock brake system.
    c. Discuss procedures for dismantling and cleaning brake system parts, including protection from hazards associated with asbestos rake pads and shoes.
    d. Inspect and diagnose brake system problem; identify needed repairs.
    e. Perform a basic overhaul for a disk type brake to include replacing pads, turning rotos, repacking wheel bearings, replacing seals, and replacing calipers.
    f. Perform a basic overhaul for a drum type brake to include replacing shoes, turning drums, and checking and replacing other parts as needed.
    g. Remove, bench bleed, and replace a master cylinder.
    h. Check and repair/replace damaged brake lines.
    i. Bleed the brake system.

    Related Academic Topics (See Appendix A):

    C1, C4
    M4
    S6, S8

    Workplace Skills (See Appendix B):

    WP2, WP4, WP5

13. Discuss the operation of brake systems used on heavy equipment and large trucks.
    a. Discuss the operation of a mechanical brake system.
    b. discuss the operation of an air brake system.
    c. discuss the operation of a wet brake system.

    Related Academic Topics (See Appendix A):

    C1, C2, C4, C6
    S6

    Workplace Skills (See Appendix B):

    WP2, WP4

14. Apply basic electrical principles as related to vehicle circuits.
    a. Describe the flow of electricity in a simple circuit including voltage, amperage, and resistance.
    b. Demonstrate the use of electrical test instruments including multimeters and continuity testers to measure voltage, amperage, and resistance.

c. Interpret wiring diagrams for a given vehicle circuit including tracing the flow of electricity in the circuit and identifying electrical symbols in the diagram.
d. Construct a simple DC circuit and test for power and continuity.
e. Diagnose an electrical circuit (horn, turn signal, etc.) for power; repair as needed.

Related Academic Topics (See Appendix A):

C2
M1, M4
S6, S8

Workplace Skills (See Appendix B):

WP2, WP4, WP5, WP6

15. Perform basic charging and starting system service.
    a. Start a car using jumper cables or auxiliary power supply.
    b. Perform battery capacity (load, high rate discharge) test and determine needed repairs, including slow/fast battery charge.
    c. Remove and replace a battery.
    d. Perform a starter draw test and a starter voltage drop test and determine needed repairs.
    e. Diagnose charging system problems that cause undercharge, overcharge, or no charge condition.
    f. Remove and replace an alternator
    g. Remove and replace a starter.

Related Academic Topics (See Appendix A):

C2, C6
M4
S5, S6, S8

Workplace Skills (See Appendix B):

WP2, WP4, WP5

CURRICULUM FRAMEWORK

Course Name: Vehicle and Mobile Equipment Mechanics II

Course CIP Code: 46.0615

Course Description: Vehicle and Mobile Equipment Mechanics II is the second and final course in the Vehicle and Mobile Mechanic program. Students enrolled in the course receive additional competencies related to service of gasoline and diesel powered vehicles in the following areas: engine performance, drive trains, steering and suspension systems, air conditioning and heating, and hydraulics. (2-2½ Carnegie units, depending upon time spent in the course)

Competencies and Suggested Objectives:

1. Inspect and evaluate engine mechanical condition.
   a. Describe common parts failures and wear points in a four cycle engine.
   b. Perform a compression test.
   c. Perform a cylinder leakage test.
   d. Diagnose unusual engine noise and vibrations and determine needed actions.
   e. Diagnose unusual exhaust color, odor, and sound; determine needed repairs.

   Related Academic Topics (See Appendix A):
   C2, C6
   M4
   S5, S6

   Workplace Skills (See Appendix B):
   WP2, WP4, WP5
2. Perform basic service on an engine.
   a. Verify correct camshaft timing; determine needed action.
   b. Grind a valve and valve seat to correct specifications.
   c. Adjust valves on engines with mechanical or hydraulic lifters.

   Related Academic Topics (See Appendix A):
   C1, C2
   M4
   S6

   Workplace Skills (See Appendix B):
   WP2, WP4, WP5
3. Perform basic service on the fuel system.
   a. Compare the operating principles of a carburetor system to a fuel injection system.
   b. Replace fuel filters according to manufacturer's schedule and procedures.

c. Inspect and test mechanical and electrical fuel pump and pump control; replace as needed.
d. Inspect fuel tank and fuel cap; inspect fuel lines, fittings, and hoses; and repair as necessary.
e. Diagnose fuel system related problems such as hard or no starting, engine misfire, hesitation, stalling, etc.; determine needed actions.

Related Academic Topics (See Appendix A):

C1, C4
M4
S5, S6

Workplace Skills (See Appendix B):

WP2, WP4, WP5

4. Perform basic service on a diesel fuel system.
   a. Identify the major components of a diesel fuel system.
   b. Identify the functions of an injector nozzle.
   c. Describe the detrimental effects caused by the presence of water in diesel fuel.
   d. Remove and replace fuel filters.
   e. Bleed air from the system.
   f. Remove, test and adjust, and replace fuel injector nozzles.

   Related Academic Topics (See Appendix A):

   C1, C4
   M4
   S5, S6

   Workplace Skills (See Appendix B):

   WP2, WP4, WP5
5. Perform basic service on the ignition system.
   a. Compare the operating principles of a conventional (distributor-type) system to an electronic ignition system.
   b. Inspect and test primary and secondary ignition system components including spark plugs and wires; determine needed repairs.
   c. Check and adjust ignition timing as needed.

   Related Academic Topics (See Appendix A):

   C1, C4
   M4
   S5, S6

   Workplace Skills (See Appendix B):

   WP2, WP4, WP5
6. Perform basic service on the emission control system.
   a. Explain the operating principles of the emission control systems including AIR, heated air induction, early fuel evaporation, EGR, PCV, evaporative emissions, and catalytic converter.
   b. Identify and locate the major components on each system on the vehicle.

c. Diagnose operation of various components of the computer-controlled engine management system using a hand-held scan tool and multimeter.

Related Academic Topics (See Appendix A):

C4, C6
S5, S6

Workplace Skills (See Appendix B):

WP2, WP4, WP5

7. Perform basic drive line service/repair.
   a. Inspect, diagnose, and replace universal joints.
   b. Remove and replace axle bearings and seals as needed.
   c. Measure differential backlash using a dial indicator.
   d. Inspect and diagnose constant-velocity (CV) joint noise and vibration problems.
   e. Remove and replace a CV-axle assembly.

   Related Academic Topics (See Appendix A):

   C4
   M4
   S6

   Workplace Skills (See Appendix B):

   WP2, WP4, WP5
8. Perform clutch service.
   a. Remove, inspect, make needed repairs, and reassemble a clutch assembly to include flywheel, pressure plate, disc, and release assembly.
   b. Adjust clutch linkage for free travel.

   Related Academic Topics (See Appendix A):

   C4
   M4
   S6

   Workplace Skills (See Appendix B):

   WP2, WP4, WP5
9. Perform basic automatic transmission service.
   a. Compare the operation of a conventional transmission to the operation of an electronic transmission, including precautions to be followed in routine service of electronic transmissions.
   b. Service a transmission to include changing fluid and filters.
   c. Visually inspect transmission including checking for leaks and examining condition of fluid.

   Related Academic Topics (See Appendix A):

   C4
   S6

   Workplace Skills (See Appendix B):

   WP2, WP4, WP5
10. Perform steering system service.
    a. Describe the procedures for four wheel alignment.

b. Compare operation of a convention steering system to a rack-and-pinion system.
c. Inspect components for wear or damage and replace/repair as needed.

Related Academic Topics (See Appendix A):

C4, C6
M4, M5
S6

Workplace Skills (See Appendix B):

WP2, WP4, WP5

11. Perform suspension system service.
    a. Compare the various types of suspension systems to include conventional, strut-type, and electronic.
    b. Inspect suspension components and determine needed repairs.
    c. Inspect shock absorbers and replace as needed.
    d. Inspect struts and replace as needed.

    Related Academic Topics (See Appendix A):

    C4
    M4
    S6

    Workplace Skills (See Appendix B):

    WP2, WP4, WP5
12. Perform basic heating system service.
    a. Describe the basic operation of a heater to include the parts and their functions.
    b. Test the operation of the heating system including motor and vacuum controls and determine needed repairs.
    c. Pressure test the system to determine leaks.

    Related Academic Topics (See Appendix A):

    C4, C6
    S6

    Workplace Skills (See Appendix B):

    WP2, WP4, WP5
13. Perform basic air conditioning system service.
    a. Describe the basic operation of the air conditioning system to include the parts and their functions.
    b. Test the operation of the air conditioning system including measuring system operating pressure on the high and low sides.
    c. Evacuate/discharge an AC system and recharge the system.
    d. Check the system for leaks and determine needed repairs.

    Related Academic Topics (See Appendix A):

    C4, C6
    S5, S6

    Workplace Skills (See Appendix B):

    WP2, WP4, WP6

14. Perform basic service on a hydraulic system.
    a. Discuss hazards and safety procedures for working with hydraulic systems.
    b. Discuss the operation of a hydraulic system including components and their functions, and operating principles.
    c. Compare the operation of a closed-center and open-center hydraulic system.
    d. Inspect a hydraulic system for leaks and determine needed repairs.

    Related Academic Topics (See Appendix A):

    C1, C2, C4, C6

    S6

    Workplace Skills (See Appendix B):

    WP2, WP4, WP5

SECTION II:

CURRICULUM GUIDE

FOR

VEHICLE AND MOBILE EQUIPMENT MECHANICS

VEHICLE AND MOBILE EQUIPMENT MECHANICS I

VEHICLE AND MOBILE EQUIPMENT MECHANICS I
UNIT 1: ORIENTATION AND SAFETY (15 days)

Competencies and Suggested Objectives:

1. Review occupational and leadership opportunities in vehicle and mobile equipment mechanics.
   a. Investigate occupational opportunities in the local area.
   b. Update the student's Career/Educational Plan.
   c. Describe leadership opportunities available from student youth organizations in the school and community, including VICA.

   Related Academic Topics (See Appendix A):
   C1, C4, C6

   Workplace Skills (See Appendix B):
   WP2, WP3, WP6
2. Demonstrate safety procedures used in vehicle service.
   a. Apply safety rules for personal and general shop safety including eye (State Eye Safety Law provisions), ear, and body protection; general rules of shop conduct; and the use of safety color coding in vehicle shops.
   b. Apply general safety rules for tool and shop equipment use including use of hand tools, air and electric power tools, and other shop equipment.
   c. Apply general safety rules associated with working on various vehicle systems.
   d. Apply rules and procedures associated with fire safety including procedures for handling and storing flammable liquids and proper use of fire fighting devices.

   Related Academic Topics (See Appendix A):
   C2, C4
   S5, S6, S8

   Workplace Skills (See Appendix B):
   WP5
3. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.
   a. Recognize signal words and symbols that indicate severity of a hazard.
   b. Describe methods for reducing hazardous waste.
   c. Describe procedures for storing hazardous waste.
   d. Interpret data found on a hazardous material safety data sheet.
   e. Describe general safety procedures for first aid and cleanup to follow in case of an accident involving hazardous materials.
   f. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.

Related Academic Topics (See Appendix A):
C1, C2, C4
S5, S8
Workplace Skills (See Appendix B):
WP2, WP3, WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Review occupational and leadership opportunities in vehicle and mobile equipment mechanics.*
   a. *Have students survey job opportunities through employer visits, resource person(s), telephone calls, help-wanted ads, or a field trip and then report their findings to the class.*
   b. *Have student update his/her Career/Educational Plan to reflect accomplishments and plans for future educational and occupational activities.*
   c. *Discuss leadership opportunities with the student, such as competitive events (VICA and Ford/AAA), award and degree programs, and committee work, that are provided through student and youth organizations. Allow students to practice leadership in class and laboratory activities.*
2. *Demonstrate safety procedures used in vehicle service.*
   a. *Provide students with reading material on safety rules related to personal safety and general shop safety.*
   b. *Demonstrate the safety rules and procedures for using tools and shop equipment. Provide simulations to allow students to practice these rules. Monitor students throughout the year on using these rules.*
   c. *Provide instruction to students on safety rules related to vehicle engines. Demonstrate the applications of these rules and provide simulations to allow students to practice these rules. Monitor students throughout the year on using these rules.*
   d. *Invite the local fire department to give a demonstration of fire safety and the use of fire detection and fighting equipment. Identify fire safety equipment, its location, and application(s) in the Vehicle and Mobile Equipment Mechanics laboratory and instruct students on its use.*
3. *Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.*
   a. *Provide students with handouts or reading materials on the handling, storing, and disposing of hazardous materials. Discuss the use of signal words and methods for reducing and storing hazardous waste*
   b. *Provide students with a copy of a hazardous material safety data sheet. Review and interpret the data found on the sheet with the class. Provide students with a second MSD for their interpretation.*

c. *Provide students with information (text or videotape) on first aid and clean-up procedures in case of a hazardous material accident. Discuss these procedures with the class. Allow students to practice these procedures through a simulation.*
d. *Discuss and demonstrate the procedures for handling, storing, and disposing of hazardous waste with the students. Have student practice these procedures through a simulation. Monitor students for compliance with these procedures throughout the year.*

Suggested Assessment Strategies:

1. *Review occupational and leadership opportunities in vehicle and mobile equipment mechanics.*
   a. *Oral and/or written report on job opportunities.*
   b. *Review of Career/Educational Plan update.*
   c. *Participation in leadership activities in class or laboratory.*
2. *Demonstrate safety procedures used in vehicle service.*
   a. *Test on safety procedures, equipment, and rules.*
   b. *Monitor students to assure that compliance with safety procedures becomes an integral part of their work habits.*
3. *Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.*
   a. *Test on hazardous materials - signal words, reducing and storing, MSD's, and safety/first aid procedures.*
   b. *Student exercise - Hazardous material accident simulation.*
   c. *Student exercise - Handling, storing, and disposing of hazardous materials.*
   d. *Monitor students to assure that compliance with hazardous materials procedures becomes an integral part of their work habits.*

Suggested References:

American Vocational Association. Hazardous Materials Fingertip Retrieval System. Alexandria, VA: American Vocational Association. 1991.

Curriculum and Instructional Materials Center (CIMC). Introduction to Automotive Service. Stillwater, OK: Oklahoma State Department of Vocational-Technical Education. 1989.

Glencoe/McGraw/Hill. Automotive Mechanics. 1993.

Goodheart-Wilcox Co. Modern Automotive Mechanics. 1994.

VEHICLE AND MOBILE EQUIPMENT MECHANICS I
UNIT 2: TOOLS, TECHNICAL REFERENCES, MEASUREMENT, AND FASTENERS **(20 days)**

Competencies and Suggested Objectives:

1. Demonstrate safe and proper use and storage of tools and equipment in a vehicle shop.
   a. Identify and demonstrate the safe and proper use of common hand tools including wrenches, sockets, pliers, screwdrivers, striking tools, etc. (See Section III of this document.)
   b. Identify and demonstrate the safe and proper use of lifting and hoisting equipment. (See Section III of this document.)
   c. Identify and demonstrate the safe and proper use of cleaning equipment. (See Section III of this document.)
   d. Identify and demonstrate the safe and proper use of power equipment including impact wrenches, drills, grinders, and presses. (See Section III of this document.)
   e. Organize and maintain a systematic storage system for hand and power tools.

   Related Academic Topics (See Appendix A):
   C2, C4
   S8

   Workplace Skills (See Appendix B):
   WP1, WP5, WP6
2. Locate and apply service specifications and information.
   a. Locate service specifications and information, using both print and compterized service information references.
   b. Interpret and apply information to a specific job on a specific vehicle.
   c. Locate and interpret vehicle and major component identification numbers (VIN, certification, and calibration labels).

   Related Academic Topics (See Appendix A):
   C1, C4
   M1, M4
   S8

   Workplace Skills (See Appendix B):
   WP2, WP5, WP6
3. Demonstrate measurement practices used in vehicle service.
   a. Measure the length of an object using a rule to the nearest 1/16th of an inch and 1 millimeter.
   b. Measure the inside diameter, outside diameter, and/or depth to the nearest .001 of an inch and nearest .1 millimeter, using precision measuring instruments (micrometers, calipers, and dial indicators).

Related Academic Topics (See Appendix A):
M4
S8
Workplace Skills (See Appendix B):
WP2, WP5

4. Identify common fasteners and describe their use.
   a. Identify the different types of bolts, nuts, and washers and describe their appropriate uses.
   b. Identify bolts by grade, diameter, length, and thread pitch.
   c. Identify different glues and sealants used in vehicle service and describe their appropriate use.
   d. Restore internal and external threads.

Related Academic Topics (See Appendix A):
C2
M1, M5
S6
Workplace Skills (See Appendix B):
WP2, WP5, WP6

Suggested Teaching Strategies:

1. *Demonstrate safe and proper use and storage of tools and equipment in a vehicle shop.*
   a. *Display tools and equipment to students, describe and demonstrate their safe and proper use, and have students perform simple jobs to demonstrate their proper use.*
2. *Locate and apply service specifications and information.*
   a. *Provide students with a copy of a service manual and computerized information system and a given service job. Have them find the necessary information and give a report to the class or record in writing.*
3. *Demonstrate measurement practices used in vehicle service.*
   a. *Identify measuring tools and instruments used in vehicle service and demonstrate their use.*
   b. *Have students practice measuring different objects to a given tolerance using each of the measuring instruments.*
4. *Identify common fasteners and describe their use.*
   a. *Display and identify the different types, sizes, and styles of fasteners and discuss their use and characteristics with the student.*
   b. *Display different glues and sealants used in vehicle service and discuss their characteristics and use.*
   c. *Identify and demonstrate the use of tools used to restore internal and external threads. Have students select the correct tool for a given situation and practice using these tools.*

Suggested Assessment Strategies:

1. *Demonstrate proper use and storage of tools and equipment in a vehicle shop.*
   a. *Test on tool identification.*
   b. *Student exercise - Demonstrate the safe and proper use of common hand tools.*
   c. *Student exercise - Demonstrate the safe and proper use of lifting and hoisting equipment.*
   d. *Student exercise - Demonstrate the safe and proper use of cleaning equipment.*
   e. *Student exercise - Demonstrate the safe and proper use of power equipment.*
   f. *Student exercise - Organize and maintain a systematic storage system for hand and power tools.*
2. *Locate and apply service specifications and information.*
   a. *Student exercise - Locate, interpret, and record service information for a specific job on a specific vehicle.*
3. *Demonstrate measurement practices used in vehicle service.*
   a. *Student exercise - Measure length with a rule.*
   b. *Student exercise - Measure inside and outside diameter and depth.*
4. *Identify common fasteners and describe their use.*
   a. *Student exercise - Select the proper fastener.*
   b. *Test - Select glues and sealants.*
   c. *Student exercise - Restore internal and external threads.*

Suggested References:

Curriculum and Instructional Materials Center (CIMC). Introduction to Automotive Service. Stillwater, OK: Oklahoma State Department of Vocational-Technical Education. 1989.

Glencoe/McGraw/Hill. Automotive Mechanics. 1993.

Goodheart-Wilcox Co. Modern Automotive Mechanics. 1994.

Microcomputer service information software (CD-ROM).

VEHICLE AND MOBILE EQUIPMENT MECHANICS I
UNIT 3: BASIC VEHICLE SERVICE **(35 days)**

Competencies and Suggested Objectives:

1. Identify and describe the major systems and components of a vehicle.
   a. Identify the major components and describe their purpose/function of following major systems:
      i. power train
      ii. chassis, steering, and suspension
      iii. fuel
      iv. electrical
      v. cooling
      vi. exhaust
   b. Describe the operation of a four-stroke cycle engine.
   c. Describe the operation of a two-stroke cycle engine.
   d. Compare the difference in a gasoline and a diesel engine.
   e. Describe the use of electronics and computer control in modern vehicles.

   Related Academic Topics (See Appendix A):
   C1, C2,C4
   S6

   Workplace Skills (See Appendix B):
   WP2, WP4, WP5
2. Perform lubrication maintenance and general inspection service.
   a. Discuss the importance of regularly scheduled maintenance procedures as outlined in the owner's manual and related to vehicle performance and longevity.
   b. Complete a work order and maintenance record for a given vehicle.
   c. Visually inspect the engine lubrication system for leaks and determine needed repairs.
   d. Select proper lubricants and filters for lubrication service.
   e. Change engine oil and filter according to manufacturer's specifications and in accordance with disposal procedures.
   f. Perform a chassis and body lubrication.
   g. Inspect and service as needed other filters on a gasoline engine including air, fuel, pcv valve, crankcase vent filters, etc.
   h. Conduct a general preventive maintenance inspection of hoses and belts, fluid levels, wiper blades, headlights and accessory lights, tires, exhaust, shocks, etc; repair/replace/adjust as needed.
   i. Clean and service a battery including case, cables and connections, and checking electrolyte level (if applicable). (Maintain electronic memory functions while cleaning.)

j. Discuss differences in servicing a diesel engine as compared to a gasoline engine, including replacing fuel filters and bleeding the diesel fuel system.

Related Academic Topics (See Appendix A):

C6
M4
S5, S6, S8

Workplace Skills (See Appendix B):

WP1, WP2, WP4, WP5

3. Perform cooling system maintenance.
   a. Service an air-cooled engine's cooling system.
   b. Drain and refill a cooling system.
   c. Inspect and pressure test a cooling system for proper operation; repair/replace thermostats, hoses, radiator caps, etc. as needed.
   d. Test condition and strength of antifreeze/coolant.

Related Academic Topics (See Appendix A):

CC4
M1
S5, S6

Workplace Skills (See Appendix B):

WP2, WP3, WP5, WP6

4. Perform wheel and tire service.
   a. Identify types and classifications for tires.
   b. Remove and install a wheel assembly to manufacturer's torque specifications.
   c. Inspect tires for proper inflation and abnormal wear.
   d. Dismount, repair, and remount a tire on a wheel.
   e. Balance a tire to industry standards.
   f. Rotate tires following vehicle manufacturer's recommendations.
   g. Diagnose and determine needed repair for abnormal tire wear, to include recognizing symptoms of incorrect camber, caster, and toe alignment.

Related Academic Topics (See Appendix A):

C1, C4
M4
S5, S6

Workplace Skills (See Appendix B):

WP2, WP3, WP5, WP6

Suggested Teaching Strategies:

1. *Identify and describe the major systems and components of a vehicle.*
   a. *Using a vehicle, visually identify the major systems and components to the students. Discuss their purpose/function.*
   b. *Have students view a videotape on the operation of a four-stroke cycle engine. Discuss the information and processes shown on this videotape.*

c. *Have students view a videotape on the operation of a two-stroke cycle engine. Discuss the information and processes shown in this videotape.*
d. *Discuss the operation of a diesel engine, including its major parts and compenents. Develop a list of differences in the operation of the two engines.*
e. *Have students read background information on electronic and computer control. Discuss the use of electronics devices and computers in modern vehicle systems (electrical, fuel, emissions, brake, and climate control.)*

2. *Perform lubrication maintenance and general inspection service.*
   a. *Provide students with examples of maintenance schedules as found in owner's manuals and dealer guides. Discuss how these schedules lead to improved performance, fewer repairs, and longer life for vehicles.*
   b. *Have students read material on lubrication maintenance and general inspections. Discuss this material with students in class and demonstrate procedures to the class. Divide students into teams and have them practice a general lubrication maintenance and inspection job using a checklist.*
3. *Perform cooling system maintenance.*
   a. *Discuss procedures for cooling system maintenance and demonstrate them to the class. Have students practice these procedures in the laboratory.*
4. *Perform automotive-type wheel and tire service.*
   a. *Have students read material related to tire and wheel service. Discuss this material with them in class. Demonstrate the procedures to the class. Have students practice procedures in laboratory.*

Suggested Assessment Strategies:

1. *Identify and describe the major systems and components of a vehicle.*
   a. *Test - Purpose and functions of each system and four-stroke cycle engine.*
   b. *Student exercise - Identify specified systems on a vehicle in the shop.*
   c. *Test - Use of computer controls in modern vehicles.*
2. *Perform lubrication maintenance and general inspection service.*
   a. *Test - Importance of proper maintenance.*
   b. *Student exercise - Lubrication and general inspection.*
3. *Perform cooling system maintenance.*
   a. *Student exercise - Cooling system maintenance.*
4. *Perform automotive-type wheel and tire service.*
   a. *Test on types and classifications of tires.*
   b. *Student exercise - Tire and wheel service.*

Suggested References:

Curriculum and Instructional Materials Center (CIMC). Introduction to Automotive Service. Stillwater, OK: Oklahoma State Department of Vocational-Technical Education. 1989.

Glencoe/McGraw/Hill. Automotive Mechanics. 1993.

Goodheart-Wilcox Co. Modern Automotive Mechanics. 1994.

VEHICLE AND MOBILE EQUIPMENT MECHANICS I
UNIT 4: BRAKES **(30 days)**

Competencies and Suggested Objectives:

1. Perform a basic overhaul of the brake system.
   a. Describe basic hydraulic principles and brake operations, including selection and handling/storage of brake fluid.
   b. Compare the operation of a standard brake system to an anti-lock brake system.
   c. Discuss procedures for dismantling and cleaning brake system parts, including protection from hazards associated with asbestos brake pads and shoes.
   d. Inspect and diagnose brake system problem; identify needed repairs.
   e. Perform a basic overhaul for a disk type brake to include replacing pads, turning rotos, repacking wheel bearings, replacing seals, and replacing calipers.
   f. Perform a basic overhaul for a drum type brake to include replacing shoes, turning drums, and checking and replacing other parts as needed.
   g. Remove, bench bleed, and replace a master cylinder.
   h. Check and repair/replace damaged brake lines.
   i. Bleed the brake system.

   Related Academic Topics (See Appendix A):
   C1, C4
   M4
   S6, S8

   Workplace Skills (See Appendix B):
   WP2, WP4, WP5

2. Discuss the operation of brake systems used on heavy equipment and large trucks.
   a. Discuss the operation of a mechanical brake system.
   b. Discuss the operation of an air brake system.
   c. Discuss the operation of a wet brake system.

   Related Academic Topics (See Appendix A):
   C1, C2, C4, C6
   S6

   Workplace Skills (See Appendix B):
   WP2, WP4

Suggested Teaching Strategies:

1. *Perform a basic overhaul of the brake system.*
   a. *Have students read materials on basic hydraulic principles, brake operations, and brake fluids. Discuss this material with them in class.*
   b. *Discuss with students the differences between standard brake systems and anti-lock systems, especially as related to service and safety.*
   c. *Discuss with the students procedures for dismantling brake system parts. Stress the importance of proper protection from hazards associated with asbestos brake shoes and pads.*
   d. *Describe and demonstrate procedures for inspecting and diagnosing brake system problems.*
   e. *Demonstrate and have students perform a basic overhaul on both a drum and disc brake unit.*
   f. *Demonstrate and have students remove, bench bleed, and replace a master cylinder.*
   g. *Demonstrate and have students check and repair/replace damaged brake lines.*
2. *Discuss the operation of brake systems used on heavy equipment and large trucks.*
   a. *Discuss the operation of a mechanical brake system with students. Use diagrams and examples if possible. Identify applications.*
   b. *Discuss the operation of an air brake system with students. Use diagrams and examples if possible. Identify applications.*
   c. *Discuss the operation of a wet brake system with students. Use diagrams and examples if possible. Identify applications.*

Suggested Assessment Strategies:

1. *Perform a basic overhaul of the brake system.*
   a. *Unit test - Basic hydraulic principles related to brake systems and system operation.*
   b. *Student exercise - Inspection and diagnosis of brake system.*
   c. *Test - Brake dismantling procedures and hazards.*
   d. *Student exercise - Basic overhaul of a disk-type brake.*
   e. *Student exercise - Basic overhaul of a drum-type brake.*
   f. *Student exercise - Remove and reinstall a master cylinder.*
   g. *Student exercise - Check and repair/replace damaged brake lines.*
2. *Discuss the operation of brake systems used on heavy equipment and large trucks.*
   a. *Test on mechanical, air, and wet brakes.*

Suggested References:

Curriculum and Instructional Materials Center (CIMC). Brakes Specialist. Stillwater, OK: Oklahoma State Department of Vocational-Technical Education. 1993.

Glencoe/McGraw/Hill. Automotive Mechanics. 1993.

Goodheart-Wilcox Co. Modern Automotive Mechanics. 1994.

VEHICLE AND MOBILE EQUIPMENT MECHANICS I
UNIT 5: BASIC ELECTRICAL SERVICE (35 days)

Competencies and Suggested Objectives:

1. Apply basic electrical principles as related to vehicle circuits.
   a. Describe the flow of electricity in a simple circuit including voltage, amperage, and resistance.
   b. Demonstrate the use of electrical test instruments including multimeters and continuity testers to measure voltage, amperage, and resistance.
   c. Interpret wiring diagrams for a given vehicle circuit including tracing the flow of electricity in the circuit and identifying electrical symbols in the diagram.
   d. Construct a simple DC circuit and test for power and continuity.
   e. Diagnose an electrical circuit (horn, turn signal, etc.) for power; repair as needed.

   Related Academic Topics (See Appendix A):
   C2
   M1, M4
   S6, S8

   Workplace Skills (See Appendix B):
   WP2, WP4, WP5, WP6
2. Perform basic charging and starting system service.
   a. Start a car using jumper cables or auxiliary power supply.
   b. Perform battery capacity (load, high rate discharge) test and determine needed repairs, including slow/fast battery charge.
   c. Remove and replace a battery.
   d. Perform a starter draw test and a starter voltage drop test and determine needed repairs.
   e. Diagnose charging system problems that cause undercharge, overcharge, or no charge condition.
   f. Remove and replace an alternator
   g. Remove and replace a starter.

   Related Academic Topics (See Appendix A):
   C2, C6
   M4
   S5, S6, S8

   Workplace Skills (See Appendix B):
   WP2, WP4, WP5

Suggested Teaching Strategies:

1. *Apply basic electrical principles as related to vehicle circuits.*
   a. *Have students read materials on the flow of electricity in a circuit and define voltage, amperage, and resistance as related to the circuit. Discuss these principles with the students.*
   b. *Demonstrate the use of the multimeter (analog and digital) and continuity tester to the students. Have students practice the use of these instruments to measure voltage, amperage, and resistance in a circuit.*
   c. *Provide students with examples of wiring diagrams from vehicles. Identify symbols used in these diagrams and discuss the devices they represent. Have students draw a simple diagram representing a given circuit.*
   d. *Have students create a simple circuit and test it for power and continuity.*
   e. *Demonstrate procedures for testing an electrical circuit. Have students practice testing simple circuits which have been disabled.*
2. *Perform basic charging and starting system service.*
   a. *Demonstrate the procedure for starting a vehicle using jumper cables or auxiliary power source. Have students practice this procedure.*
   b. *Demonstrate the procedure for performing a battery capacity test and determining battery state and performing a slow/fast battery charge. Have students practice this procedure.*
   c. *Demonstrate the procedure for removing and reinstalling a battery. Have students practice this procedure.*
   d. *Demonstrate the procedure for performing a starter draw test and a starter voltage drop test and for determining needed repairs. Have students practice needed repairs.*
   e. *Demonstrate the procedure for diagnosing charging system problems that cause undercharge, overcharge, or no charge condition.*
   f. *Demonstrate the procedure for removing and replacing an alternator. Have students practice this procedure.*
   g. *Demonstrate the procedure for removing and replacing a starter. Have students practice this procedure.*

Suggested Assessment Strategies:

1. *Apply basic electrical principles as related to vehicle circuits.*
   a. *Test on basic principles of electricity.*
   b. *Student exercise - Interpret wiring diagrams.*
   c. *Student exercise - Build a simple circuit.*
   d. *Student exercise - Diagnose a simple circuit.*
2. *Perform basic charging and starting system service.*
   a. *Test on basic charging and starting system service.*
   b. *Student exercise - Jump start a car.*

c. *Student exercise - Perform battery capacity test and slow/fast charge.*
d. *Student exercise - Remove and replace a battery.*
e. *Student exercise - Starter draw test and voltage drop test.*
f. *Student exercise - Diagnose charging system problems.*
g. *Student exercise - Remove and replace an alternator*
h. *Student exercise - Remove and replace a starter.*

Suggested References:

Curriculum and Instructional Materials Center (CIMC). Electrical Systems Specialist. Stillwater, OK: Oklahoma State Department of Vocational-Technical Education. 1992.

Glencoe/McGraw/Hill. Automotive Mechanics. 1993.

Goodheart-Wilcox Co. Modern Automotive Mechanics. 1994.

VEHICLE AND MOBILE EQUIPMENT MECHANICS II

VEHICLE AND MOBILE EQUIPMENT MECHANICS II
UNIT 1: ENGINE PERFORMANCE - GASOLINE AND DIESEL (65 days)

Competencies and Suggested Objectives:

1. Inspect and evaluate engine mechanical condition.
   a. Describe common parts failures and wear points in a four cycle engine.
   b. Perform a compression test.
   c. Perform a cylinder leakage test.
   d. Diagnose unusual engine noise and vibrations and determine needed actions.
   e. Diagnose unusual exhaust color, odor, and sound; determine needed repairs.

   Related Academic Topics (See Appendix A):
   C2, C6
   M4
   S5, S6

   Workplace Skills (See Appendix B):
   WP2, WP4, WP5
2. Perform basic service on an engine.
   a. Verify correct camshaft timing; determine needed action.
   b. Grind a valve and valve seat to correct specifications.
   c. Adjust valves on engines with mechanical or hydraulic lifters.

   Related Academic Topics (See Appendix A):
   C1, C2
   M4
   S6

   Workplace Skills (See Appendix B):
   WP2, WP4, WP5
3. Perform basic service on the fuel system.
   a. Compare the operating principles of a carburetor system to a fuel injection system.
   b. Replace fuel filters according to manufacturer's schedule and procedures.
   c. Inspect and test mechanical and electrical fuel pump and pump control; replace as needed.
   d. Inspect fuel tank and fuel cap; inspect fuel lines, fittings, and hoses; and repair as necessary.
   e. Diagnose fuel system related problems such as hard or no starting, engine misfire, hesitation, stalling, etc.; determine needed actions.

Related Academic Topics (See Appendix A):
C1, C4
M4
S5, S6
Workplace Skills (See Appendix B):
WP2, WP4, WP5

4. Perform basic service on a diesel fuel system.
   a. Identify the major components of a diesel fuel system.
   b. Identify the functions of an injector nozzle.
   c. Describe the detrimental effects caused by the presence of water in diesel fuel.
   d. Remove and replace fuel filters.
   e. Bleed air from the system.
   f. Remove, test and adjust, and replace fuel injector nozzles.

   Related Academic Topics (See Appendix A):
   C1, C4
   M4
   S5, S6
   Workplace Skills (See Appendix B):
   WP2, WP4, WP5

5. Perform basic service on the ignition system.
   a. Compare the operating principles of a conventional (distributor-type) system to an electronic ignition system.
   b. Inspect and test primary and secondary ignition system components including spark plugs and wires; determine needed repairs.
   c. Check and adjust ignition timing as needed.

   Related Academic Topics (See Appendix A):
   C1, C4
   M4
   S5, S6
   Workplace Skills (See Appendix B):
   WP2, WP4, WP5

6. Perform basic service on the emission control system.
   a. Explain the operating principles of the emission control systems including AIR, heated air induction, early fuel evaporation, EGR, PCV, evaporative emissions, and catalytic converter.
   b. Identify and locate the major components on each system on the vehicle.
   c. Diagnose operation of various components of the computer-controlled engine management system using a hand-held scan tool and multimeter.

   Related Academic Topics (See Appendix A):
   C4, C6
   S5, S6
   Workplace Skills (See Appendix B):
   WP2, WP4, WP5

Suggested Teaching Strategies:

1. *Inspect and evaluate engine mechanical condition.*
   a. *Have students read material on causes of parts failures and wear. Discuss these causes in class.*
   b. *Demonstrate procedure for compression testing. Have students practice the procedure.*
   c. *Demonstrate procedure for cylinder leakage test. Have students practice the procedure.*
   d. *Discuss characteristics and symptoms for unusual engine noise and vibrations and their remedies.*
   e. *Discuss characteristics and symptoms for unusual exhaust color, odor, and sound and their remedies.*
2. *Perform basic service on an engine.*
   a. *Demonstrate the procedure for verifying correct camshaft timing and determining needed action. Have students practice the procedure.*
   b. *Demonstrate procedure for grinding a valve and valve seat. Have students practice the procedure.*
   c. *Demonstrate the procedures for adjusting valves on engines with mechanical and hydraulic lifters. Have students practice one of the procedures.*
3. *Perform basic service on a gasoline fuel system.*
   a. *Have students read material on operating principles of carburetor and electronic fuel injection systems. Compare and discuss these principles in class.*
   b. *Discuss the different types of fuel filters and their location on the vehicle. Demonstrate procedures for replacing filters and allow students to practice these procedures.*
   c. *Discuss the location of fuel pumps on different vehicles and the procedures that are used to remove and replace them. Demonstrate procedures for testing, removing, and replacing electric and mechanical fuel pumps. Have students practice these procedures.*
   d. *Discuss and demonstrate procedures for inspecting the fuel tank (exterior), fuel cap, and fuel lines, fittings, and hoses. Demonstrate these procedures to the class and have students practice them.*
   e. *Have students read material on fuel system problems including symptoms and possible causes and remedies. Discuss this material with the class. If possible, simulate a problem in a fuel system and allow students to locate the problem and correct it.*
4. *Perform basic service on a diesel fuel system.*
   a. *Identify the major components of a diesel engine to the class. Discuss the function of each component.*
   b. *Display a fuel injector to the class. Discuss the functions of the injector.*

c. *Describe and discuss with the class the detrimental effects of water in fuel. If possible, show examples of damage that can occur.*
d. *Describe and demonstrate to the class the procedure for removing and replacing a fuel filter. Have students practice the procedure.*
e. *Describe and demonstrate the procedure for bleeding air from diesel systems. Have students practice the procedure.*
f. *Describe and demonstrate the procedure for removing, testing and adjusting, and replacing injector nozzles. Have students demonstrate these procedures.*

5. *Perform basic service on the ignition system.*
   a. *Have students read material on conventional (distributor) and electronic ignition systems. Discuss this material with the students in class and compare the two systems.*
   b. *Demonstrate the procedures for testing primary and secondary ignition system components and for determining needed repairs. Have students practice these procedures.*
   c. *Demonstrate the procedures for checking and adjusting (if applicable) ignition timing. Have students practice these procedures.*
6. *Perform basic service on the emission control system.*
   a. *Provide information to students on the basic principles of the different emission control systems (textbook or videotape). Discuss these principles with the students.*
   b. *Using a vehicle in the shop, show the students the different components of the engine emission control system.*
   c. *Demonstrate the procedures for reading trouble codes from the computer-controlled engine management system using a hand-held scanner and with a multimeter. Have students practice these procedures.*

Suggested Assessment Strategies:

1. *Inspect and evaluate engine mechanical condition*
   a. *Test on common parts failure and wear.*
   b. *Student exercise - Perform compression test.*
   c. *Student exercise - Perform cylinder leakage test.*
   d. *Test on unusual exhaust noise and vibrations.*
   e. *Test on unusual exhaust odor, color, and sound.*
2. *Perform basic service on an engine.*
   a. *Student exercise - Verify correct camshaft timing.*
   b. *Student exercise - Grind a valve and valve seat.*
   c. *Student exercise - Adjust valve clearance (hydraulic or mechanical lifters).*
3. *Perform basic service on a gasoline fuel system.*
   a. *Test on operating principles of carburetor and electronic fuel injection systems.*
   b. *Student exercise - Replace fuel filter.*

c. *Student exercise - Test and replace a fuel pump.*
d. *Student exercise - Inspect and repair fuel tank, fuel cap, and fuel lines, fittings, and hoses.*
e. *Student exercise - Diagnose fuel system related problems.*

4. *Perform basic service on a diesel fuel system.*
   a. *Test - Components of a diesel fuel system.*
   b. *Test - Functions of injector nozzle.*
   c. *Test - Detrimental effects of water.*
   d. *Student exercise - Remove and replace fuel filter.*
   e. *Student exercise - Bleed air from a diesel fuel system.*
   f. *Student exercise - Remove, test and adjust, and replace fuel system nozzles.*
5. *Perform basic service on the ignition system.*
   a. *Student assignment - Compare conventional and electronic ignition systems.*
   b. *Student exercise - Inspect and test primary and secondary ignition components.*
   c. *Student exercise - Check and adjust ignition timing.*
6. *Perform basic service on the emission control system.*
   a. *Test - Operating principles of emission control system.*
   b. *Student exercise - Identify components of the emission control system.*
   c. *Student exercise - Diagram operation of the emission control system.*

Suggested References:

Curriculum and Instructional Materials Center (CIMC). Engine Repair Specialist. Stillwater, OK: Oklahoma State Department of Vocational-Technical Education. 1989.

Delmar. Motor Automotive Technology. 1993.

Glencoe/McGraw/Hill. Automotive Mechanics. 1993.

Goodheart-Wilcox Co. Modern Automotive Mechanics. 1994.

Mid-America Vocational Curriculum Consortium. Diesel Fundamentals. 1988.

VEHICLE AND MOBILE EQUIPMENT MECHANICS II
UNIT 2: DRIVE TRAINS **(30 days)**

Competencies and Suggested Objectives:

1. Perform basic drive line service/repair.
   a. Inspect, diagnose, and replace universal joints.
   b. Remove and replace axle bearings and seals as needed.
   c. Measure differential backlash using a dial indicator.
   d. Inspect and diagnose constant-velocity (CV) joint noise and vibration problems.
   e. Remove and replace a CV-axle assembly.

   Related Academic Topics (See Appendix A):
   C4
   M4
   S6

   Workplace Skills (See Appendix B):
   WP2, WP4, WP5
2. Perform clutch service.
   a. Remove, inspect, make needed repairs, and reassemble a clutch assembly to include flywheel, pressure plate, disc, and release assembly.
   b. Adjust clutch linkage for free travel.

   Related Academic Topics (See Appendix A):
   C4
   M4
   S6

   Workplace Skills (See Appendix B):
   WP2, WP4, WP5
3. Perform basic automatic transmission service.
   a. Compare the operation of a conventional transmission to the operation of an electronic transmission, including precautions to be followed in routine service of electronic transmissions.
   b. Service a transmission to include changing fluid and filters.
   c. Visually inspect transmission including checking for leaks and examining condition of fluid.

   Related Academic Topics (See Appendix A):
   C4
   S6

   Workplace Skills (See Appendix B):
   WP2, WP4, WP5

Suggested Teaching Strategies:

1. *Perform basic drive line service/repair.*
   a. *Discuss and demonstrate procedures for inspecting, diagnosing, and replacing universal joints. Have students practice these procedures.*
   b. *Discuss and demonstrate procedures for removing and replacing axle bearings and seals. Have students practice these procedures.*
   c. *Discuss and demonstrate procedures for measuring differential backlash using a dial indicator. Have students practice these procedures.*
2. *Perform clutch service.*
   a. *Discuss and demonstrate procedures for removing, inspecting, repairing and reassembling a clutch. Have students practice these procedures in class.*
   b. *Discuss and demonstrate procedures for adjusting clutch free travel. Have students practice these procedures.*
3. *Perform basic automatic transmission service.*
   a. *Discuss with the class the operation of conventional automatic transmissions and compare these to the operation of electronic transmissions. Stress the importance of procedures to follow in servicing electronic transmissions.*
   b. *Discuss and demonstrate procedures for changing fluid and filters. Have students practice these procedures.*
   c. *Describe and demonstrate the procedures for visually inspecting a transmission and the condition of its fluid. Have students practice these procedures in class.*

Suggested Assessment Strategies:

1. *Perform basic drive line service/repair.*
   a. *Test on material discussed in class.*
   b. *Student exercise - Remove and replace axle bearings and seals.*
   c. *Student exercise - Measure differential backlash.*
2. *Perform clutch service.*
   a. *Test on material discussed in class.*
   b. *Student exercise - Remove, inspect, repair, and reassemble a clutch assembly.*
   c. *Student exercise - Adjust clutch linkage free travel.*
3. *Perform basic automatic transmission service.*
   a. *Test - Compare conventional and electronic transmissions.*
   b. *Student exercise - Service a transmission.*
   c. *Student exercise - Inspect a transmission.*

Suggested References:

Curriculum and Instructional Materials Center (CIMC). Maunal Drive Train/Axles Specialist. Stillwater, OK: Oklahoma State Department of Vocational-Technical Education. 1992.

Delmar. Motor Automotive Technology. 1993.

Glencoe/McGraw/Hill. Automotive Mechanics. 1993.

Goodheart-Wilcox Co. Modern Automotive Mechanics. 1994.

VEHICLE AND MOBILE EQUIPMENT MECHANICS II
UNIT 3: STEERING AND SUSPENSION SYSTEMS (20 days)

Competencies and Suggested Objectives:

1. Perform steering system service.
   a. Describe the procedures for four wheel alignment.
   b. Compare operation of a convention steering system to a rack-and-pinion system.
   c. Inspect components for wear or damage and replace/repair as needed.

   Related Academic Topics (See Appendix A):
   C4, C6
   M4, M5
   S6

   Workplace Skills (See Appendix B):
   WP2, WP4, WP5
2. Perform suspension system service.
   a. Compare the various types of suspension systems to include conventional, strut-type, and electronic.
   b. Inspect suspension components and determine needed repairs.
   c. Inspect shock absorbers and replace as needed.
   d. Inspect struts and replace as needed.

   Related Academic Topics (See Appendix A):
   C4
   M4
   S6

   Workplace Skills (See Appendix B):
   WP2, WP4, WP5

Suggested Teaching Strategies:

1. *Perform steering system service*
   a. *Have students read materials on front and rear end alignment. Discuss these procedures with the students. Demonstrate procedures if equipment is available or take students on a field trip to observe alignment.*
   b. *Discuss operations of conventional and rack-and-pinion steering systems and compare the two systems.*
   c. *Discuss and demonstrate procedures for inspecting wear and damage on steering system components. Have students practice these procedures.*

2. *Perform suspension system service.*
   a. *Provide students with information on conventional, strut-type, and electronic suspensions (textbook or videotape). Discuss this information in class and compare the three systems.*
   b. *Discuss and demonstrate inspection of suspension components and ways that repairs can be made. Have students make an inspection and report their findings.*
   c. *Discuss and demonstrate procedures for inspecting, removing, and replacing shock absorbers. Have students practice these procedures.*
   d. *Discuss and demonstrate procedures for inspecting, removing, and replacing struts. Have students practice these procedures.*

Suggested Assessment Strategies:

1. *Perform steering system service.*
   a. *Test on four wheel alignment procedure.*
   b. *Student exercise - Inspect steering system components.*
2. *Perform suspension system service.*
   a. *Test on suspension systems.*
   b. *Student exercise - Inspect suspension components and determine needed repairs.*
   c. *Student exercise - Inspect, remove, and replace shock absorbers.*
   d. *Student exercise - Inspect, remove, and replace struts.*

Suggested References:

Curriculum and Instructional Materials Center (CIMC). Steering and Suspension Specialist. Stillwater, OK: Oklahoma State Department of Vocational-Technical Education. 1991.

Delmar. Motor Automotive Technology. 1993.

Glencoe/McGraw/Hill. Automotive Mechanics. 1993.

Goodheart-Wilcox Co. Modern Automotive Mechanics. 1994.

VEHICLE AND MOBILE EQUIPMENT MECHANICS II
UNIT 4: AIR CONDITIONING AND HEATING SERVICE (10 days)

(**NOTE:** All practices and procedures performed on sealed air conditioning systems **must** be performed under the direct supervision of an instructor who is certified to service air conditioning and refrigeration equipment. All practices and procedures **must** be performed in accordance with current mandates, standards, and regulations regarding refrigerant systems.)

Competencies and Suggested Objectives:

1. Perform basic heating system service.
   a. Describe the basic operation of a heater to include the parts and their functions.
   b. Test the operation of the heating system including motor and vacuum controls and determine needed repairs.
   c. Pressure test the system to determine leaks.

   Related Academic Topics (See Appendix A):
   C4, C6
   S6

   Workplace Skills (See Appendix B):
   WP2, WP4, WP5
2. Perform basic air conditioning system service.
   a. Describe the basic operation of the air conditioning system to include the parts and their functions.
   b. Test the operation of the air conditioning system including measuring system operating pressure on the high and low sides.
   c. Evacuate/discharge an AC system and recharge the system.
   d. Check the system for leaks and determine needed repairs.

   Related Academic Topics (See Appendix A):
   C4, C6
   S5, S6

   Workplace Skills (See Appendix B):
   WP2, WP4, WP6

Suggested Teaching Strategies:

1. Perform basic heating system service.
   a. Provide students with information on the basic operation of a heater. Discuss this information with the students including identifying the parts and functions.

b. *Discuss and demonstrate the procedure for testing the operation of the heating system including motor and vacuum controls. Discuss solutions and repairs to common problems. Have students practice the procedures.*
c. *Discuss and demonstrate the procedures for testing a heater for leaks. Have students practice these procedures.*

2. *Perform basic air conditioning system service.*
   a. *Have students read background material on vehicle air conditioning. Discuss this material in class including the parts and functions of an air conditioning system.*
   b. *Discuss and demonstrate procedures for testing the operation of an air conditioning system including measuring system operating pressure on the high and low sides.*
   c. *Discuss and demonstrate the evacuation/discharge of an AC system and recharge of the system. Be sure to discuss environmental regulations regarding the discharge of R-12 into the atmosphere. (Note: Instructors must be certified and follow proper procedures.)*
   d. *Discuss and demonstrate the procedures for checking an air conditioning system for leaks and procedures for correcting leaks. Have students practice the inspection procedures and determine needed repairs to the system.*

Suggested Assessment Strategies:

1. *Perform basic heating system service.*
   a. *Test on topics discussed in class.*
   b. *Student exercise - Test the operation of a heating system.*
2. *Perform basic air conditioning system service.*
   a. *Test on topics discussed in class.*
   b. *Student exercise - Test the operation of an air conditioning system.*
   c. *Student exercise - Evacuate/discharge and recharge an AC system.*
   d. *Student exercise - Check an AC system for leaks.*

Suggested References:

Curriculum and Instructional Materials Center (CIMC). Heating and Air Conditioning Specialist. Stillwater, OK: Oklahoma State Department of Vocational-Technical Education. 1989.

Delmar. Motor Automotive Technology. 1993.

Glencoe/McGraw/Hill. Automotive Mechanics. 1993.

Goodheart-Wilcox Co. Modern Automotive Mechanics. 1994.

VEHICLE AND MOBILE EQUIPMENT MECHANICS II
UNIT 5: HYDRAULICS (10 days)

Competencies and Suggested Objectives:

1. Perform basic service on a hydraulic system.
   a. Discuss hazards and safety procedures for working with hydraulic systems.
   b. Discuss the operation of a hydraulic system including components and their functions, and operating principles.
   c. Compare the operation of a closed-center and open-center hydraulic system.
   d. Inspect a hydraulic system for leaks and determine needed repairs.

   Related Academic Topics (See Appendix A):
   C1, C2, C4, C6
   S6

   Workplace Skills (See Appendix B):
   WP2, WP4, WP5

Suggested Teaching Strategies:

1. *Perform basic service on a hydraulic system.*
   a. *Discuss hazards and safety procedures for working with hydraulic systems, including risk of hydraulic fluid poisoin and precautions to follow in servicing hydraulic systems.*
   b. *Discuss the operation of a hydraulic system including components and their functions, and operating principles. Be sure to discuss and illustrate the different types pumps, valves, cylinders, and other devices associated with hydraulic systems.*
   c. *Compare the operation of a closed-center and open-center hydraulic system. Use diagrams or videotape if possible to illustrate this concept.*
   d. *Demonstrate the procedures for inspection of a hydraulic system for leaks and for determining needed repairs. Provide students with a problem in which they have to determine needed repairs on a system.*

Suggested Assessment Strategies:

1. *Perform basic service on a hydraulic system.*
   a. *Test on hydraulic system safety, operation, and components.*
   b. *Student exercise - Diagnose repairs to a leaking hyrdaulic system.*

Suggested References:

Mid-America Vocational Curriculum Consortium. Hydraulics. Stillwater, OK: MAVCC. 1986.

SECTION III:

RECOMMENDED TOOLS AND EQUIPMENT

RECOMMENDED TOOLS AND EQUIPMENT FOR SECONDARY VEHICLE AND MOBILE EQUIPMENT MECHANICS

1. Student Tool Kit (1 kit per 2 students)
   a. Adjustable wrenches (2) 6" and 12"
   b. Allen wrench sets - standard (.050" - 3/8") and metric (2mm - 7mm)
   c. Brake spoon
   d. Chisels - cape (5/16") and cold (3/8" & 3/4")
   e. Claw type pickup tool
   f. Combination wrench sets - standard (1/4" - 1") and metric (7mm - 19 mm)
   g. Continuity test light (12v)
   h. Feeler gauge (blade type) .002" - .040 " and .006 mm - .070 mm
   i. Hack saw
   j. Hammer - 16 oz. ball peen
   k. Hammer - plastic tip
   l. Ignition wrench set - US and metric
   m. Magnetic pickup tool
   n. Pliers - combination 6", locking jaw, needle nose, side cutting, and slip joint (water pump)
   o. Punches - center, brass drift, pin (1/8", 3/16", 1/4", 5/16") , and taper (3/8", 1/2", 5/8")
   p. Scrapers - carbon 1" and gasket 1"
   q. Screwdrivers - standard (stubby, 6", 9", 12", and offset) and Phillips (stubby #1, #2; 6" #1, #2; 12" #3)
   r. Screw starters - standard and Phillips
   s. Socket set - 1/4" drive - 1/4"-1/2" standard sockets, 1/4"-1/2" deep sockets, 6mm-12mm standard sockets, 6mm-12mm deep sockets, flex/universal type handle, 3" and 6" extensions, ratchet
   t. Socket set - 3/8" drive - 5/16"-3/4" standard sockets; 3/8"-3/4" deep sockets; 9mm-19mm standard sockets; 9mm-19mm deep sockets; 3", 6", 12", and 18" extensions; flexhead ratchet; ratchet; speed handle; universal joint; spark plug sockets (5/8" & 13/16")
   u. Socket set - 1/2" drive - 7/16" - 1 1/8" standard sockets; 7/16" - 1 1/8" deep sockets; 10mm-25mm standard sockets; 10mm-25mm deep sockets; 3",6", and 12" extensions; flex/universal type handle, ratchet
   v. Spark plug feeler gauge (gap tool)
2. Air blow gun (OSHA approved) (2 per program)
3. Battery post cleaner (2 per program)
4. Battery terminal pliers (2 per program)
5. Battery terminal puller (2 per program)
6. Files - coarse 6"& 12", fine 6"& 12", half-round 12", and round 6" & 12"
7. Flare nut (tubing wrenches) 3/8" - 3/4" and 10mm - 17mm (1 set per program)

8. Flashlight (4 per program)
9. Fuel system pressure gauge with adapters (1 per program)
10. Hammer - dead blow plastic mallet (1 per program)
11. Jumper wire set (1 per program)
12. Pliers - hose clamp (1 per program)
13. Pry bars - rolling head and straight (2 per program)
14. Screwdriver set - Posidrive® #1-#4 (1 set per program)
15. Screwdriver set - Torx® T-8 - T-55 (2 sets per program)
16. 3/8" drive air ratchet (1 per program)
17. 3/8" drive impact sockets (US and metric) (2 sets per program)
18. 3/8" drive impact wrench (1 per program)
19. 3/8" drive flexible socket set (US and metric) (1 per program)
20. 1/2" drive air impact wrench (2 per program)
21. 1/2" drive impact sockets (US and metric) (2 sets per program)
22. Air chisel with various bits (1 per program)
23. Air compressor and hoses (1 per program)
24. Axle stands (6 sets per program)
25. Battery charger/booster starter (1 per program)
26. Belt tensioner gauge (1 per program)
27. Bench or pedestal grinder (2 per program)
28. Compression tester (3 per program)
29. Computer scan tool (hand-held) - on-board diagnostics level II (4 per program of various brands)
30. Cooling system pressure tester (1 per program)
31. Floor creeper (1 per 2 students)
32. Cylinder leakage tester (1 per program)
33. Dial indicator with flex arm and clamp base (2 per program)
34. Digital multimeter with various leadsets (1 per 2 students)
35. Drain pans (6 per program)
36. Drill - 3/8" variable speed (4 per program)
37. Drill - 1/2" variable speed (1 per program)
38. Extension cords (4 per program)
39. Fender covers (10 per program)
40. Fuel pressure testing gauge set with adaptors (1 per program)
41. Floor jack (1 1/2 ton minimum capacity) (3 per program)
42. Gear lube dispenser (1 per program)
43. Hand held vacuum pump (1 per program)
44. Hoist(s)-Engine (1 per program)
45. Hot plate (or equivalent) (1 per program)
46. Hydraulic press with adapters (25 ton) (1 per program)
47. Jumper cables (3 sets per program)
48. Master puller set (1 per program)
49. Microcomputer with monitor, printer, CD-ROM drive and cables (1 per program)

50. Microcomputer service information software (CD-ROM) (1 set per program)
51. Outside micrometers (0-1", 1-2", 2-3", 3-4", 4-5") (1 set per program)
52. Oil can - pump type (1 per program)
53. Oil filter wrench(es) (1 set per program, various sizes)
54. Parts cleaning tank (1 per program)
55. Pressure washer (1 per program)
56. Remote starter switch (1 per program)
57. Screw extractor set (1 per program)
58. Seat covers (10 per program)
59. Snap ring pliers set - external and internal (1 set per program)
60. Soldering gun (1 per program)
61. Soldering iron (25 watt pencil type) (1 per program)
62. Spark plug boot puller (5 per program)
63. Steel top workbenches with vises (1 per 2 students)
64. Tach/dwell meter (1 per program)
65. Tap and die set (US and metric) (1 per program)
66. Thread repair insert kit (1 per program)
67. Tire inflator chuck (2 per program)
68. Trouble/work lights (1 per 2 students)
69. Tube quick disconnect tool set (1 per program)
70. Tubing cutter and flaring set (1 per program)
71. Twist steel drill bit set (1/64" - 1/2" (2 sets per program)
72. Valve core removal tool (2 per program)
73. Vernier calipers (0-6" and 0-125mm) (1 set per program)
74. Waste oil receptacle (1 per program)
75. Ball joint press (1 per program)
76. Bearing packer (1 per program)
77. Brake pedal holder (1 per program)
78. Drag link tool (1 per program)
79. Inner tie rod end tool (1 per program)
80. Pitman arm puller (1 per program)
81. Shock absorber tools (1 per program)
82. Spring/strut compressor tool (1 per program)
83. Tie rod puller (1 per program)
84. Tire mounting machine (1 per program)
85. Wheel balancer (1 per program)
86. Wheel weight pliers (1 per program)
87. Brake bleeder, pressure (1 per program)
88. Brake cylinder clamps (1 per program)
89. Brake disc micrometer (1 per program)
90. Brake drum micrometer (1 per program)
91. Brake lathe with disc service attachments (1 per program)
92. Brake shoe adjusting gauge (1 per program)
93. Brake spring installers (1 per program)

94. Brake spring pliers (1 per program)
95. Asbestos containment/removal device (1 per program)
96. Refrigerant recovery/recycling machine (R-12) (1 per program)
97. Refrigerant recovery/recycling machine (HFC-134a) (1 per program)
98. A/C service port adapter set (1 per program)
99. Mainfold gauge set (1 per program)
100. Antifreeze tester (1 per program)
101. Batter/starter/charging system tester (1 per program)
102. Carburetor plug and angle gauge set (1 per program)
103. Computer carburetor tools (1 per program)
104. Cylinder leakage tester (1 per program)
105. Oxygen sensor socket (1 per program)
106. Sending unit socket (1 per program)
107. Spark plug thread tap (1 per program)
108. Static strip (4 per program)
109. Timing advance light (4 per program)
110. Vacuum/pressure gauge set (2 per program)
111. Front wheel drive engine support fixture (2 per program)
112. Power Train (cradle) removal and installation tool (2 per program)
113. Transmission jack(s) (1 per program)
114. Transmission holding fixtures (1 per program)
115. Transmission special tools set (1 per program)
116. Alternator service tools (1 per program)
117. Connector pick tool set (1 per program)
118. Wire and terminal repair kit (4 per program)
119. Clutch alignment set (1 per program)
120. Clutch pilot puller set (1 per program)
121. Special tools for transaxles (1 per program)
122. Universal joint tools (1 per program)
123. Valve and valve seat resurfacing equipment (1 per program)
124. Valve guide repair unit (1 per program)
125. Valve spring compressor (1 per program)
126. Valve spring tester (1 per program)
127. Hydraulic pressure testing gauge (1 per program)
128. Diesel fuel injector nozzle pop tester (1 per program)
129. Arc welder (1 per program)
130. Oxyacetylene welding and cutting set (1 per program)
131. Fuel system pressure testing gauge w/adapters (1 per program)

APPENDIX A:

RELATED ACADEMIC TOPICS

APPENDIX A

RELATED ACADEMIC TOPICS FOR COMMUNICATIONS

C1 Interpret written material.
C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
C3 Listen, comprehend, and take appropriate actions.
C4 Access, organize, and evaluate information.
C5 Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.
C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.

EXPANDED TOPICS FOR COMMUNICATIONS

TOPIC C1: Interpret written material.

C1.01 Read and follow complex written directions.
C1.02 Recognize common words and meanings associated with a variety of occupations.
C1.03 Adjust reading strategy to purpose and type of reading.
C1.04 Use sections of books and reference sources to obtain information.
C1.05 Compare information from multiple sources and check validity.
C1.06 Interpret items and abbreviations used in multiple forms.
C1.07 Interpret short notes, memos, and letters.
C1.08 Comprehend technical words and concepts.
C1.09 Use various reading techniques depending on purpose for reading.
C1.10 Find, read, understand, and use information from printed matter or electronic sources.

TOPIC C2: Interpret visual materials (maps, charts, graphs, tables, etc.).

C2.01 Use visuals in written and in oral presentations.
C2.02 Recognize visual cues to meaning (layout, typography, etc.).
C2.03 Interpret and apply information using visual materials.

TOPIC C3: Listen, comprehend, and take appropriate action.

C3.01 Identify and evaluate orally-presented messages according to purpose.
C3.02 Recognize barriers to effective listening.
C3.03 Recognize how voice inflection changes meaning.
C3.04 Identify speaker signals requiring a response and respond accordingly.
C3.05 Listen attentively and take accurate notes.
C3.06 Use telephone to receive information.

C3.07 Analyze and distinguish information from formal and informal oral presentations.

TOPIC C4: Access, organize, and evaluate information.

C4.01 Distinguish fact from opinion.
C4.02 Use various print and non-print sources for specialized information.
C4.03 Interpret and distinguish between literal and figurative meaning.
C4.04 Interpret written or oral communication in relation to context and writer's point of view.
C4.05 Use relevant sources to gather information for written or oral communication.

TOPIC C5: Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.

C5.01 Select appropriate words for communication needs.
C5.02 Use reading, writing, listening, and speaking skills to solve problems.
C5.03 Compose inquiries and requests.
C5.04 Write persuasive letters and memos.
C5.05 Edit written reports, letters, memos, and short notes for clarity, correct grammar, and effective sentences.
C5.06 Write logical and understandable statements, phrases, or sentences for filling out forms, for correspondence or reports.
C5.07 Write directions or summaries of processes, mechanisms, events, or concepts.
C5.08 Select and use appropriate formats for presenting reports.
C5.09 Convey information to audiences in writing.
C5.10 Compose technical reports and correspondence that meet accepted standards for written communications.

TOPIC C6: Communicate ideas and information using oral and written forms for a variety of audiences and purposes.

C6.01 Give complex oral instructions.
C6.02 Describe a business or industrial process/mechanism.
C6.03 Participate effectively in group discussions and decision making.
C6.04 Produce effective oral messages utilizing different media.
C6.05 Explore ideas orally with partners.
C6.06 Participate in conversations by volunteering information when appropriate and asking relevant questions when appropriate.
C6.07 Restate or paraphrase a conversation to confirm one's own understanding.
C6.08 Gather and provide information utilizing different media.

C6.09 Prepare and deliver persuasive, descriptive, and demonstrative oral presentations.

RELATED ACADEMIC TOPICS FOR MATHEMATICS

M1 Relate number relationships, number systems, and number theory.
M2 Explore patterns and functions.
M3 Explore algebraic concepts and processes.
M4 Explore the concepts of measurement.
M5 Explore the geometry of one-, two-, and three-dimensions.
M6 Explore concepts of statistics and probability in real world situations.
M7 Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.

EXPANDED TOPICS FOR MATHEMATICS

TOPIC M1: Relate number relationships, number systems, and number theory.

M1.01 Understand, represent, and use numbers in a variety of equivalent forms (integer, fraction, decimal, percent, exponential, and scientific notation) in real world and mathematical problem situations.
M1.02 Develop number sense for whole numbers, fractions, decimals, integers, and rational numbers.
M1.03 Understand and apply ratios, proportions, and percents in a wide variety of situations.
M1.04 Investigate relationships among fractions, decimals, and percents.
M1.05 Compute with whole numbers, fractions, decimals, integers, and rational numbers.
M1.06 Develop, analyze, and explain procedures for computation and techniques for estimations.
M1.07 Select and use an appropriate method for computing from among mental arithmetic, paper-and-pencil, calculator, and computer methods.
M1.08 Use computation, estimation, and proportions to solve problems.
M1.09 Use estimation to check the reasonableness of results.

TOPIC M2: Explore patterns and functions.

M2.01 Describe, extend, analyze, and create a wide variety of patterns.
M2.02 Describe and represent relationships with tables, graphs, and rules.
M2.03 Analyze functional relationships to explain how a change in one quantity results in a change in another.
M2.04 Use patterns and functions to represent and solve problems.
M2.05 Explore problems and describe results using graphical, numerical, physical, algebraic, and verbal mathematical models or representations.

M2.06 Use a mathematical idea to further their understanding of other mathematical ideas.

M2.07 Apply mathematical thinking and modeling to solve problems that arise in other disciplines, such as art, music, and business.

TOPIC M3: Explore algebraic concepts and processes.

M3.01 Represent situations and explore the interrelationships of number patterns with tables, graphs, verbal rules, and equations.

M3.02 Analyze tables and graphs to identify properties and relationships and to interpret expressions and equations.

M3.03 Apply algebraic methods to solve a variety of real world and mathematical problems.

TOPIC M4: Explore the concepts of measurement.

M4.01 Estimate, make,and use measurements to describe and compare phenomena.

M4.02 Select appropriate units and tools to measure to the degree of accuracy required in a particular situation.

M4.03 Extend understanding of the concepts of perimeter, area, volume, angle measure, capacity, and weight and mass.

M4.04 Understand and apply reasoning processes, with special attention to spatial reasoning and reasoning with proportions and graphs.

TOPIC M5: Explore the geometry of one-, two-, and three-dimensions.

M5.01 Identify, describe, compare, and classify geometric figures.

M5.02 Visualize and represent geometric figures with special attention to developing spatial sense.

M5.03 Explore transformations of geometric figures.

M5.04 Understand and apply geometric properties and relationships.

M5.05 Classify figures in terms of congruence and similarity and apply these relationships.

TOPIC M6: Explore the concepts of statistics and probability in real world situations.

M6.01 Systematically collect, organize, and describe data.

M6.02 Construct, read, and interpret tables, charts, and graphs.

M6.03 Develop an appreciation for statistical methods as powerful means for decision making.

M6.04 Make predictions that are based on exponential or theoretical probabilities.

M6.05 Develop an appreciation for the pervasive use of probability in the real world.

TOPIC M7: Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.

M7.01 Use computers and/or calculators to process information for all mathematical situations.
M7.02 Use problem-solving approaches to investigate and understand mathematical content.
M7.03 Formulate problems from situations within and outside mathematics.
M7.04 Generalize solutions and strategies to new problem situations.

RELATED ACADEMIC TOPICS FOR SCIENCE

S1 Explain the Anatomy and Physiology of the human body.
S2 Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.
S3 Relate the nine major phyla of the kingdom anomaly according to morphology, anatomy, and physiology.
S4 Explore the chemical and physical properties of the earth to include Geology, Meteorology, Oceanography, and the Hydrologic Cycle.
S5 Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.
S6 Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.
S7 Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance, population genetics, the structure and function of DNA, and current applications of DNA technology.
S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

EXPANDED TOPICS FOR SCIENCE

TOPIC S1: Explain the Anatomy and Physiology of the human body.

S1.01 Recognize common terminology and meanings.
S1.02 Explore the relationship of the cell to more complex systems within the body.

S1.03 Summarize the functional anatomy of all the major body systems.
S1.04 Relate the physiology of the major body systems to its corresponding anatomy.
S1.05 Compare and contrast disease transmission and treatment within each organ system.
S1.06 Explore the usage of medical technology as related to human organs and organ systems.
S1.07 Explain the chemical composition of body tissue.

TOPIC S2: Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.

S2.01 Identify the major types and structures of plants, viruses, monera, algae protista, and fungi.
S2.02 Explain sexual and asexual reproduction.
S2.03 Describe the ecological importance of plants as related to the environment.
S2.04 Analyze the physical chemical and behavioral process of a plant.

TOPIC S3: Relate the nine major phyla of the kingdom anomaly according to morphology, anatomy, and physiology.

S3.01 Explain the morphology, anatomy, and physiology of animals.
S3.02 Describe the characteristics, behaviors, and habitats of selected animals.

TOPIC S4: Explore the chemical and physical properties of the earth to include Geology, Meteorology, Oceanography, and the Hydrologic Cycle.

S4.01 Examine minerals and their identification, products of the rock cycle, byproducts of weathering, and the effects of erosion.
S4.02 Relate the Hydrologic Cycle to include groundwater its zones, movement, and composition; surface water systems, deposits, and runoff.
S4.03 Consider the effects of weather and climate on the environment.
S4.04 Examine the composition of seawater; wave, tides, and currents; organisms, environment, and production of food; energy, food and mineral resources of the oceans.

TOPIC S5: Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.

S5.01 Examine the science of chemistry to include the nature of matter, symbols, formulas and nomenclature, and chemical equations.

S5.02 Identify chemical reactions including precipitation, acids-bases, and reduction-oxidation.
S5.03 Explore the fundamentals of chemical bonding and principles of equilibrium.
S5.04 Relate the behavior of gases.
S5.05 Investigate the structure, reactions, and uses of organic compounds; and investigate nuclear chemistry and radiochemistry.

TOPIC S6: Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.

S6.01 Examine fundamentals of motion of physical bodies and physical dynamics.
S6.02 Explore the concepts and relationships among work, power, and energy.
S6.03 Explore principles, characteristics, and properties of electricity, magnetism, light energy, thermal energy, and wave energy.
S6.04 Identify principles of modern physics related to nuclear physics.

TOPIC S7: Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance; population genetics, the structure and function of DNA, and current applications of DNA technology.

S7.01 Examine principles, techniques, and patterns of traits and inheritance in organisms.
S7.02 Apply the concept of population genetics to both microbial and multicellular organism.
S7.03 Identify the structure and function of DNA and the uses of DNA technology in science, industry, and society.

TOPIC S8: Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

S8.01 Apply the components of scientific processes and methods in classroom and laboratory investigations.
S8.02 Observe and practice safe procedures in the classroom and laboratory.
S8.03 Demonstrate proper use and care for scientific equipment.
S8.04 Investigate science careers, and advances in technology.
S8.05 Communicate results of scientific investigations in oral, written, and graphic form.

APPENDIX B:

WORKPLACE SKILLS

APPENDIX B
WORKPLACE SKILLS FOR THE 21ST CENTURY

WP1 Allocates resources (time, money, materials and facilities, and human resources).

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.

WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.

WP5 Selects, applies, and maintains/troubleshoots technology.

WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.

APPENDIX C:

STUDENT COMPETENCY PROFILE

STUDENT COMPETENCY PROFILE
FOR VEHICLE AND MOBILE EQUIPMENT MECHANICS I

Student: _____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Orientation and Safety

_____ 1. Review occupational and leadership opportunities in vehicle and mobile equipment mechanics.
_____ 2. Demonstrate safety procedures used in vehicle service.
_____ 3. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.

Unit 2: Tools, Technical References, Measurement, and Fasteners

_____ 1. Demonstrate safe and proper use and storage of tools and equipment in a vehicle shop.
_____ 2. Locate and apply service specifications and information.
_____ 3. Demonstrate measurement practices used in vehicle service.
_____ 4. Identify common fasteners and describe their use.

Unit 3: Basic Vehicle Service

_____ 1. Identify and describe the major systems and components of a vehicle.
_____ 2. Perform lubrication maintenance and general inspection service.
_____ 3. Perform cooling system maintenance.
_____ 4. Perform wheel and tire service.

Unit 4: Brakes

_____ 1. Perform a basic overhaul of the brake system.
_____ 2. Discuss the operation of brake systems used on heavy equipment and large trucks.

Unit 5: Basic Electrical Service

_____1. Apply basic electrical principles as related to vehicle circuits.
_____2. Perform basic charging and starting system service.

STUDENT COMPETENCY PROFILE
FOR VEHICLE AND MOBILE EQUIPMENT MECHANICS II

Student: _____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Engine Performance - Gasoline and Diesel

_____ 1. Inspect and evaluate engine mechanical condition.
_____ 2. Perform basic service on an engine.
_____ 3. Perform basic service on the fuel system.
_____ 4. Perform basic service on a diesel fuel system.
_____ 5. Perform basic service on the ignition system.
_____ 6. Perform basic service on the emission control system.

Unit 2: Drive Trains

_____ 1. Perform basic drive line service/repair.
_____ 2. Perform clutch service.
_____ 3. Perform basic automatic transmission service.

Unit 3: Steering and Suspension Systems

_____ 1. Perform steering system service.
_____ 2. Perform suspension system service.

Unit 4: Air Conditioning and Heating Service

_____ 1. Perform basic heating system service.
_____ 2. Perform basic air conditioning system service.

Unit 5: Hydraulics

_____ 1. Perform basic service on a hydraulic system.